

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Atty. Docket No: 16313-0029

In re patent application of

COSTA E SILVA, OSWALDO DA

Serial No. 09/828,302

Filed: April 6, 2001

For: PHOSPHATASE STRESS-RELATED PROTEINS AND METHODS OF USE IN PLANTS

STATEMENT TO SUPPORT FILING AND SUBMISSION IN
ACCORDANCE WITH 37 C.F.R. §§ 1.821-1.825

Assistant Commissioner for Patents
Washington, D.C. 20231
Box SEQUENCE

Sir:

In connection with a Sequence Listing submitted concurrently herewith, the undersigned hereby states that:

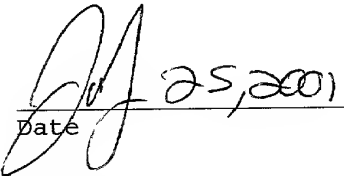
1. the submission, filed herewith in accordance with 37 C.F.R. § 1.821(g), does not include new matter;
2. the content of the attached paper copy and the attached computer readable copy of the Sequence Listing, submitted in accordance with 37 C.F.R. § 1.821(c) and (e), respectively, are the same; and
3. all statements made herein of their own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United

100220 20032350

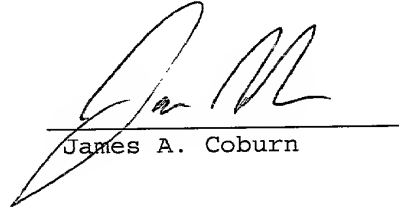
Serial No. 09/828,302

States Code and that such willful false statements may jeopardize the validity of the application or any patent resulting therefrom.

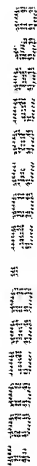
Respectfully submitted,


Date

HARBOR CONSULTING
Intellectual Property Services
1500A Lafayette Road
Suite 262
Portsmouth, N.H.
800-318-3021


James A. Coburn

100230 20030304



SEQUENCE LISTING

<120> PHOSPHATASE STRESS-RELATED PROTEINS AND METHODS OF USE
IN PLANTS

<141> 2001-04-06

<151> 2000-04-07

<160> 46

<170> PatentIn Ver. 2.1

 $\langle 210 \rangle$ 1

<211> 656

<212> DNA

<213> Physcomitrella patens

<400> 1

gcacgaggag	gacaagtcctt	cgaacccag	cttagagtac	tggttcaagt	gtgtagacct	60
ggattgtgac	gggatgatta	tgtacgagg	agatgcaata	tttttacgag	gagcaacttc	120
atcggatgga	gtgcatggct	caggagcctg	ttctttttga	ggatatcggt	tgtcaaata	180
cagatatgat	cggacctgct	aatgaaggac	ggttgacact	tccggactta	aagcgatgca	240
aattatctgg	aaacttcctc	aatatccttt	ttaacctcaa	caaattcgta	gtttttgaga	300
ctcgtgatcc	tttccttatt	cgtcaggaga	gagaggaccc	gtcattaact	gagtgggatc	360
gatttgaca	cattgagtac	atccgacttt	caatggaaga	agatggcgag	gatgcctcca	420
acggcagtgc	tgaagtcctg	gatgagcctg	gttacgaagc	ccccctttaa	ccttctgttg	480
tccctcaaga	tccaggcatg	tgaatcatca	gagcagagac	ggacggcacg	agaacttgcc	540
tgctggactt	ttaaagaaaac	tggctctgtc	aacctcttaa	agggtgtcat	ttatatcgta	600
aagcatcttg	ttgagtgagc	atcctgccta	ggggaccctg	tctctacttt	aacatc	656

 $\langle 210 \rangle \quad 2$

<211> 807

<212> DNA

<213> Physcomitrella patens

<400> 2

cggcacgagg	aagcaggtta	gaacctcaat	gtggatcccg	gagctagagg	aaatgggagt	60
ttgctgacaa	atagtatgtt	gcttaatcca	aagggcttgg	caccacgtct	atcatcaaac	120
ggaggacctg	tgacacgagg	catgccgtaa	tcagccagga	ctttgtattt	cctcctggag	180
gcattccgtc	acttcatctt	ccctcggtag	tagtttggag	taacgaaacg	acattagttg	240
cgagatgtag	aagagtctac	gcaaacgctc	atgcataatca	catcaactcc	atatccaaca	300
acagcgattg	tgagacatac	atatctgcag	atgatttgag	aataaaattta	tggaaccttg	360
aagttagtga	tcagagtttc	aacattgttg	acatcaaacc	aacaaacatg	gaagacctta	420
cagagggtgat	aacgtctcgca	gagttccatc	ctactcattg	caatgtgtta	gcatacagta	480
gcagcaaggg	ctccattcga	ctcattgata	tgcgtcaatc	agccttgtgt	gatcgacact	540
ctaaagctgt	ttcaggaaga	actggagccc	atccgtgatac	caagatcctt	tttttcacag	600
aaatccatag	cttcaatttc	tgacattaag	tttgcaagag	gcgatcggtta	cattctccag	660

```
<210> 3
<211> 447
<212> DNA
<213> Physcomitrella patens
```

```
<210> 4
<211> 591
<212> DNA
<213> Physcomitrella patens
```

```
<210> 5
<211> 587
<212> DNA
<213> Physcomitrella patens
```

```
<220>
<221> modified_base
<222> (283)
<223> a, t, c, g, other or unknown
```

```
<400> 5
cggcacacng tttgtaccgc catttacaga aattgccacc caacatgggg gaatgtctag 60
tgaggttcct cagtcaagcc tttaagcaga ccgaggaggg gtttttggaa atcgtaaggg 120
attcatggct cacgaagccc cagattgctg ccgttggttc ctgttgcttg gtaggtgtgg 180
```

```

tgtgggagtg taagctgtac atcgccagcc tgggtgattc taaggctgtg ctcggtagat 240
tctctcgcaa tttgcaatca gtaattgcga cggagatatc ctntctgagca taacgccagt 300
gttgaggctg ttaggcagga cctgcaagct ggcgcatcctg atgacccgcg cattgttgtg 360
ctgaggcacg gagtgtggcg tgtgaagggt ttgattcaag tctctcgatc cattggcgac 420
gtttatctga agaaggctga gttcaaccgt gagcctctaa tcggccgggt cgcctgcca 480
gagccgctcc agagaccgct catgagcgcc gagccggaca tccgagtaat cgatctgacc 540
ccagatgtgg agttgtgatt ttgcatcaga tgggttgtgg gagcact 587

```

<210> 6

<211> 2559

<212> DNA

<213> *Physcomitrella patens*

<400> 6

```

atccccgggca tcgggaaaga cgggtgtgtgt gtgtgtgtgt gtttgcttgc ttgcatgcat 60
tgtgggggggt acccagatca tgcttcagggt aggtttggag tgcgcccagt ggagcccttg 120
acgtttggccg tggcagatct ggaccccgat ctgcttcaac tccctgcgga tttcaccctc 180
tttgcttctc cttcatcgct atcgctgct tctgtgggag ttagcaacaa gcttggagggt 240
gtttgtagggt tgcacttggg ggagctttac gcgcaatgga ttctgctgcc cgacacgcag 300
cgtctgggta cgaatttgtt ggaagaagca aaaggaggag ctggacaccc aaatgttggc 360
ctatcacttt tgccagggtc tctatctgga gccgcaggaa gcaactcccc gttgcctcct 420
cggagctctg gttcaccaat gtctcccagg tcgcctttca gcagacgtat gggaactagc 480
cacctcatgc gggactctcc gttgaagaaa agtagcgaa ctgtgcgaga gatcataccc 540
cagttctatt ttccgaatgg gcccccgcca tcgaaggata ccattgagtc gtgcatggct 600
cgcgtaaacc aaatattcgg agctcatcca gaaggtttac ctgcatcagc atttgcaacc 660
attactaagg atgtatgcaa actaccgtcc ttcttctcca tggctttatt caaaaagatt 720
gacatcaata atacaggctt gggttacaagg gacaagttcg tagaatactg ggtggaccaag 780
aacatgctgg ccatggacac tgcaactcgc gtcttcaact tgttgaagca acccgacaag 840
aattttctga gacaggaaga ttttaggccc gttttacgag aattgttgtt gacgcatcgc 900
ggtttggaat ttctccatga cccccggag tttcaagaca gatatgctga aactgtaata 960
tacagaatat tctacatgt aaatagagct gggaatggct ggctacaact tagagagtta 1020
aagcggagta atttaattgc tgctcttcag caagtggatg aagaggaaga catcaacaaa 1080
gtgttacgtt acttctcata tgaacatttt tatgtcatat attgcaagtt ctgggagctg 1140
gattcagatc acgatttttt aatagacaaa gatgatctcc ttcgatatgg aaatcatgct 1200
ctcacctacc gaatcgtaga gcgtatcttt tcccagggtc caagaaagtt caccagcaa 1260
gtagctggaa agatgggtta tgaagacttc gtatgggtta ttctttcaga agaggacaag 1320
tcttccgaac ccagcttaga gtactgggtc aagtgtgtag acctggattg tgacgggatg 1380
attatactaa atgagatgca atatttttac gaggagcaac ttcacggtat ggagtgcag 1440
gctcaggagc ctggtctttt tgaggatata gtttgtcaaa tgacagatat gatcggacct 1500
gctaattgaa gacgggtgac acttcgggac ttaaagcgat gcaaattatc tggaaacttc 1560
ttcaatatcc tttttaacct caacaaattc gtagcttttg agactcgtga tcctttcctt 1620
attcgtcagg agagagagga cccgtcatta actgagtggt atcgatttgc acacattgag 1680
tacatccgac tttcaatgga agaagatggc gaggatgcct ccaacggcag tgctgaagtc 1740
tgggatgagc ctggttacga agcccccttt taaccttctg ttgtccctca agatccaggc 1800
atltgaatca tcagagcaga gacggacggc acgaagaatt gcctgctgga cttttaagaa 1860
aactggtctg tgcaaccctt taaagggtgt ccatttatat cgtaaagcat cttgtttgag 1920
tgagcatcct gcctaggggg accctgtctc tacttttaaa tcagacaatg catgtgacat 1980
ttgtacagtt cacaaatggc agcatttata tatttaggaa gtccttcaac attatatctt 2040
tcaggctctc agctcgccat ttacgggtgc tactgttaact cgagtccttg tgcaagaatc 2100
atgaagaata ctgagcatgg cgacgtccaa aacttcgaga caacgtcaaa gaactacttg 2160
accggtctct caacaagttc tgttacttaa gtgcacagca ctggggtagc cctcttgctt 2220
tcaaaatcac tgtgtgtgac actgtagcta ctacttcagg gaaattgatg ttgggcattc 2280
taggccttct gagctttttt tgcaggctct tttgatggct tccgtcacgt tatttgttta 2340
ggaatgaagc agcctgccc ggaatgtgat gtagacatgg tccggtttct gatcttctca 2400
atcaggctta accatgcagt aattaagcag gtaggcacag tgtgctcaac acgtaatccc 2460
cttcccacac tagtcttctc tgtagactct ttatttcagc ttttgatccg gaacttaag 2520
cttttgactg gttcagcccg aggtcggtag cgtttaacgc 2559

```

<210> 7
 <211> 2005
 <212> DNA
 <213> *Physcomitrella patens*

<400> 7
 atcccgggtg gtggtggcgg tgaagttatt acccgagagc ttcgacagct tcacgcatgt 60
 ttgcgattgc acgcaaggac gcaactggct ccgtagtgtg aatgaatgga ttcaccgcga 120
 tgcaagcttc tcaacgagcc gttggaagct tcgtgtggtg gagtgtggaa actgccggag 180
 ctccgtaacc atgcgggggt catggaagtg gtggctgcca attcggaggc ggatttcaat 240
 gtggtagagt ttggacttag agttttgtag gaggaggggt tgaagtgtgg gccaaagtgt 300
 ggggctcctg aaacagggga aaagaaaaag agacgacgac gccggagatt ggagattgag 360
 gtgtgtgtgt gtgtgtttgt ggtagttta gcggtttgaa gtgatgatca gtggtgcaag 420
 cggggcaccg gctggggccc cagttcccac tgctactggg tctgttgctg cgccattgcc 480
 cgcgttgagg tggaaattct cgcagggttt cggcgagcgt gccatcggag aggaagtgca 540
 agaagttgat attatctcgg ctattgagtt tgataagact ggagaacatt tggcgactgg 600
 cgacagagga ggacgcgttg tactttttga gagaacagat ggcaaagatc aaaggacacg 660
 gagagagttg gaaagagctg attctgcggg gtccaggcat cctgaatata gatactctac 720
 cgagtttcaa agtcatgaac cagagtttga ttacttgaag agtttggaaa tagaggagaa 780
 gatcaataaa attagatggt gtcagactgc caacgccgct cagttcttaa tttctacgaa 840
 tgacaaaacc attaaattat ggaaggtgac tgaaaagaaa gtgaagcaag tcaagaacct 900
 gaatgtggat cctggagcca gagggaatgg aaaccattg tcgaataaca tgatgctcaa 960
 tccaaagggg tttgcaccac ggttgtcgat gaatggagtt gcccgcaacc gatctacgcc 1020
 tgccatcagc cctgactttg tatttcctcc tggaggcatt ccgtctcttc atcttccctc 1080
 ggtatggagt aacgagacgg cattagtgtc gagatgtaga agagcctacg caaacgctca 1140
 tgcataatcat atcaactcca tatctaacia cagcgattgt gagacataca tctctgcaga 1200
 tgatttgaga ataaatttat ggaatcttga agttagtgtg cagagtttca atattgttga 1260
 catcaaacca acaaacatgg aagaccttac agaggtgata acgtctgcag agttccatcc 1320
 ttctcattgc aatgtgttag catacagtag cagcaagggc tctattcgac tcattgatat 1380
 gcgtcaatca gccttgtgtg atcgacattc aaagctgttt gaggagactg agcatgctgg 1440
 atcaagatcc ttttttacag aaatcatagc ttctatttct gatattaagt ttgcgagagg 1500
 cggtcggtac attctgagtc gggactacat gactctgaaa ttgtgggatg tgaacatgga 1560
 atcttccctc gtggccgtat ttaaagtcca cgagtatttg cgtccaaagc tttgtgatct 1620
 ctatgagaac gactccatct tgcacaagtt tgaatgttgt cttagtgggg atggcatgcg 1680
 tgtggcaact ggttcctaca gcaacttgtt ccgggtgttt ggggcccgtc ccggaagtga 1740
 ggaagcgtca accttggaag ctagcaagac tccaaacagg cgtatcgtga cactccctc 1800
 aaaagctgca agtcgactag ccaatcttgc tcgtggtcgg cgtgataacc gtcgaggtgg 1860
 agaaagccca ggtatagatt tgaatggggg agtgcaagat ttcacatcaa agcttttgca 1920
 cttagcatgg catccagcag cgaatgtgat cgctttcgcg ctagcgcgtt gctcgtgca 1980
 tccaacagct tgtacatgtt aacgc 2005

<210> 8
 <211> 1365
 <212> DNA
 <213> *Physcomitrella patens*

<400> 8
 ggcgttaacg cgcggaggag agcggatcgg ttagggtttg gtgccagggg ggagggcaga 60
 ggttgggaca atgccgtcat atgcagatgt agaccggcag atagagcagc tgtcggagtg 120
 caagccgttg tcggagttag aggtgaagaa cctatgtgat caagctcgga cgatcttggt 180
 ggaggagtgg aacgtgcagc ccgtgaagtg tctgtcacg gtttgcgggt acatccatgg 240
 ccagtttcat gatctcatcg agcttttccg cataggaggc aaggcgccc acacgaacta 300
 cttgttcatg ggcgactatg tggatcgtgg atattattct gtcgagactg tgtcgtctct 360
 agtggccctg aagggtcggg ataggatag gatcacaatc ttgcgagggg accacgagag 420
 caggcagatt acgcaagtat atggtttcta tgatgaatgc ctgcggaagt atggaaatgc 480

```
<210> 9
<211> 1346
<212> DNA
<213> Physcomitrella patens
```

```
<210> 10
<211> 1410
<212> DNA
<213> Physcomitrella patens
```

```
<400> 10
atccccgggcg tggaggaga gggaaatgttg aggaaagagt ggagttatta tttgtcagtc 60
gaatgtacag gaagaagcga aaaggtatg gagtggaaat atgaagaagc tgggtgaaga 120
aggacgtctg agagatgcta gagtggatga tgaagatgtt gatggcatgt tggcgccgg 180
tgcaaaaata cagcacctg ggggaggaga atggagataa ccacgaccca ctgctgtggc 240
```

```
<210> 11
<211> 572
<212> PRT
<213> Physcomitrella patens
```

```
<400> 11
Met His Cys Gly Gly Tyr Pro Asp His Ala Ser Gly Arg Phe Gly Val
      1             5             10             15
```

Arg Pro Met Glu Pro Leu Thr Leu Ala Val Ala Asp Leu Asp Pro Asp
20 25 30

Leu Leu Gln Leu Pro Ala Asp Phe Thr Pro Phe Ala Ser Pro Ser Ser
35 40 45

Ser Ser Pro Ala Ser Val Gly Val Ser Asn Lys Leu Gly Gly Val Cys
50 55 60

Arg Leu His Leu Glu Glu Leu Tyr Ala Gln Trp Ile Ser Leu Pro Asp
65 70 75 80

Thr Gln Arg Leu Val Thr Asn Leu Leu Glu Glu Ala Lys Gly Gly Ala
85 90 95

Gly His Pro Asn Val Gly Leu Ser Leu Leu Pro Gly His Leu Ser Gly
100 105 110

Ala Ala Gly Ser Thr Pro Pro Leu Pro Pro Arg Ser Ser Gly Ser Pro
115 120 125

Met Ser Pro Arg Ser Pro Phe Ser Arg Arg Met Gly Thr Ser His Leu
130 135 140

Met Arg Asp Ser Pro Leu Lys Lys Ser Ser Glu Pro Val Arg Glu Ile
145 150 155 160

Ile	Pro	Gln	Phe	Tyr	Phe	Pro	Asn	Gly	Pro	Pro	Ser	Lys	Asp	Thr	
				165									175		
								170							
Ile	Glu	Ser	Cys	Met	Ala	Arg	Val	Asn	Gln	Ile	Phe	Gly	Ala	His	Pro
			180					185					190		
Glu	Gly	Leu	Pro	Ala	Ser	Ala	Phe	Ala	Thr	Ile	Thr	Lys	Asp	Val	Cys
		195					200					205			
Lys	Leu	Pro	Ser	Phe	Phe	Ser	Met	Ala	Leu	Phe	Lys	Lys	Ile	Asp	Ile
	210					215					220				
Asn	Asn	Thr	Gly	Leu	Val	Thr	Arg	Asp	Lys	Phe	Val	Glu	Tyr	Trp	Val
225					230					235					240
Asp	Gln	Asn	Met	Leu	Ala	Met	Asp	Thr	Ala	Thr	Arg	Val	Phe	Thr	Val
				245					250					255	
Leu	Lys	Gln	Pro	Asp	Lys	Asn	Phe	Leu	Arg	Gln	Glu	Asp	Phe	Arg	Pro
			260					265					270		
Val	Leu	Arg	Glu	Leu	Leu	Leu	Thr	His	Arg	Gly	Leu	Glu	Phe	Leu	His
		275					280					285			
Asp	Thr	Pro	Glu	Phe	Gln	Asp	Arg	Tyr	Ala	Glu	Thr	Val	Ile	Tyr	Arg
	290					295					300				
Ile	Phe	Tyr	His	Val	Asn	Arg	Ala	Gly	Asn	Gly	Arg	Leu	Gln	Leu	Arg
305					310					315					320
Glu	Leu	Lys	Arg	Ser	Asn	Leu	Ile	Ala	Ala	Leu	Gln	Gln	Val	Asp	Glu
				325					330					335	
Glu	Glu	Asp	Ile	Asn	Lys	Val	Leu	Arg	Tyr	Phe	Ser	Tyr	Glu	His	Phe
			340					345					350		
Tyr	Val	Ile	Tyr	Cys	Lys	Phe	Trp	Glu	Leu	Asp	Ser	Asp	His	Asp	Phe
		355					360					365			
Leu	Ile	Asp	Lys	Asp	Asp	Leu	Leu	Arg	Tyr	Gly	Asn	His	Ala	Leu	Thr
	370					375					380				
Tyr	Arg	Ile	Val	Glu	Arg	Ile	Phe	Ser	Gln	Val	Pro	Arg	Lys	Phe	Thr
385					390					395					400
Ser	Lys	Val	Ala	Gly	Lys	Met	Gly	Tyr	Glu	Asp	Phe	Val	Trp	Phe	Ile
				405					410					415	
Leu	Ser	Glu	Glu	Asp	Lys	Ser	Ser	Glu							

Glu Pro Val Leu Phe Glu Asp Ile Val Cys Gln Met Thr Asp Met Ile
465 470 475 480

Gly Pro Ala Asn Glu Gly Arg Leu Thr Leu Arg Asp Leu Lys Arg Cys
485 490 495

Lys Leu Ser Gly Asn Phe Phe Asn Ile Leu Phe Asn Leu Asn Lys Phe
500 505 510

Val Ala Phe Glu Thr Arg Asp Pro Phe Leu Ile Arg Gln Glu Arg Glu
515 520 525

Asp Pro Ser Leu Thr Glu Trp Asp Arg Phe Ala His Ile Glu Tyr Ile
530 535 540

Arg Leu Ser Met Glu Glu Asp Gly Glu Asp Ala Ser Asn Gly Ser Ala
545 550 555 560

Glu Val Trp Asp Glu Pro Gly Tyr Glu Ala Pro Phe
565 570

<210> 12

<211> 532

<212> PRT

<213> *Physcomitrella patens*

<400> 12

Met Ile Ser Gly Ala Ser Gly Ala Pro Ala Gly Ala Pro Val Pro Thr
1 5 10 15

Ala Thr Gly Ser Val Ala Ala Pro Leu Pro Ala Leu Glu Trp Lys Phe
20 25 30

Ser Gln Val Phe Gly Glu Arg Ala Ile Gly Glu Glu Val Gln Glu Val
35 40 45

Asp Ile Ile Ser Ala Ile Glu Phe Asp Lys Thr Gly Glu His Leu Ala
50 55 60

Thr Gly Asp Arg Gly Gly Arg Val Val Leu Phe Glu Arg Thr Asp Gly
65 70 75 80

Lys Asp Gln Arg Thr Arg Arg Glu Leu Glu Arg Ala Asp Ser Ala Gly
85 90 95

Ser Arg His Pro Glu Tyr Arg Tyr Ser Thr Glu Phe Gln Ser His Glu
100 105 110

Pro Glu Phe Asp Tyr Leu Lys Ser Leu Glu Ile Glu Glu Lys Ile Asn
115 120 125

Lys Ile Arg Trp Cys Gln Thr Ala Asn Ala Ala Gln Phe Leu Ile Ser
130 135 140

Thr Asn Asp Lys Thr Ile Lys Leu Trp Lys Val Thr Glu Lys Lys Val
145 150 155 160

1002220 2022220

9/20

Lys Gln Val Lys Asn Leu Asn Val Asp Pro Gly Ala Arg Gly Asn Gly
 165 170 175
 Asn Pro Leu Ser Asn Asn Met Met Leu Asn Pro Lys Gly Phe Ala Pro
 180 185 190
 Arg Leu Ser Met Asn Gly Val Ala Ala Asn Arg Ser Thr Pro Ala Ile
 195 200 205
 Ser Pro Asp Phe Val Phe Pro Pro Gly Gly Ile Pro Ser Leu His Leu
 210 215 220
 Pro Ser Val Trp Ser Asn Glu Thr Ala Leu Val Ala Arg Cys Arg Arg
 225 230 235 240
 Ala Tyr Ala Asn Ala His Ala Tyr His Ile Asn Ser Ile Ser Asn Asn
 245 250 255
 Ser Asp Cys Glu Thr Tyr Ile Ser Ala Asp Asp Leu Arg Ile Asn Leu
 260 265 270
 Trp Asn Leu Glu Val Ser Asp Gln Ser Phe Asn Ile Val Asp Ile Lys
 275 280 285
 Pro Thr Asn Met Glu Asp Leu Thr Glu Val Ile Thr Ser Ala Glu Phe
 290 295 300
 His Pro Ser His Cys Asn Val Leu Ala Tyr Ser Ser Ser Lys Gly Ser
 305 310 315 320
 Ile Arg Leu Ile Asp Met Arg Gln Ser Ala Leu Cys Asp Arg His Ser
 325 330 335
 Lys Leu Phe Glu Glu Thr Glu His Ala Gly Ser Arg Ser Phe Phe Thr
 340 345 350
 Glu Ile Ile Ala Ser Ile Ser Asp Ile Lys Phe Ala Arg Gly Gly Arg
 355 360 365
 Tyr Ile Leu Ser Arg Asp Tyr Met Thr Leu Lys Leu Trp Asp Val Asn
 370 375 380
 Met Glu Ser Ser Pro Val Ala Val Phe Lys Val His Glu Tyr Leu Arg
 385 390 395 400
 Pro Lys Leu Cys Asp Leu Tyr Glu Asn Asp Ser Ile Phe Asp Lys Phe
 405 410 415
 Glu Cys Cys Leu Ser Gly Asp Gly Met Arg Val Ala Thr Gly Ser Tyr
 420 425 430
 Ser Asn Leu Phe Arg Val Phe Gly Ala Ala Thr Gly Ser Glu Glu Ala
 435 440 445
 Ser Thr Leu Glu Ala Ser Lys Thr Pro Asn Arg Arg Ile Val Thr Pro
 450 455 460

1002230-2002230

Pro Ser Lys Ala Gly Ser Arg Leu Ala Asn Leu Ala Arg Gly Arg Arg
465 470 475 480

Asp Asn Arg Arg Gly Gly Glu Ser Pro Gly Ile Asp Leu Asn Gly Gly
485 490 495

Val Gln Asp Phe Thr Ser Lys Leu Leu His Leu Ala Trp His Pro Ala
500 505 510

Ala Asn Val Ile Ala Phe Ala Leu Ala Arg Cys Ser Leu His Pro Thr
515 520 525

Ala Cys Thr Cys
530

<210> 13

<211> 306

<212> PRT

<213> Physcomitrella patens

<400> 13

Met Pro Ser Tyr Ala Asp Val Asp Arg Gln Ile Glu Gln Leu Ser Glu
1 5 10 15

Cys Lys Pro Leu Ser Glu Leu Glu Val Lys Asn Leu Cys Asp Gln Ala
20 25 30

Arg Thr Ile Leu Val Glu Glu Trp Asn Val Gln Pro Val Lys Cys Pro
35 40 45

Val Thr Val Cys Gly Asp Ile His Gly Gln Phe His Asp Leu Ile Glu
50 55 60

Leu Phe Arg Ile Gly Gly Lys Ala Pro Asp Thr Asn Tyr Leu Phe Met
65 70 75 80

Gly Asp Tyr Val Asp Arg Gly Tyr Tyr Ser Val Glu Thr Val Ser Leu
85 90 95

Leu Val Ala Leu Lys Val Arg Tyr Arg Asp Arg Ile Thr Ile Leu Arg
100 105 110

Gly Asn His Glu Ser Arg Gln Ile Thr Gln Val Tyr Gly Phe Tyr Asp
115 120 125

Glu Cys Leu Arg Lys Tyr Gly Asn Ala Asn Val Trp Lys Tyr Phe Thr
130 135 140

Asp Leu Phe Asp Tyr Leu Pro Leu Thr Ala Leu Ile Glu His Glu Ile
145 150 155 160

Phe Cys Leu His Gly Gly Leu Ser Pro Ser Leu Asp Thr Leu Asp His
165 170 175

Ile Arg Ala Leu Asp Arg Ile Gln Glu Val Pro His Glu Gly Pro Met
180 185 190

09223022250

Cys Asp Leu Leu Trp Ser Asp Pro Asp Asp Arg Cys Gly Trp Gly Ile
195 200 205

Ser Pro Arg Gly Ala Gly Tyr Thr Phe Gly Gln Asp Ile Ala Glu Gln
210 215 220

Phe Asn His Thr Asn Gly Leu Ser Leu Val Ala Arg Ala His Gln Leu
225 230 235 240

Val Met Glu Gly Tyr Asn Trp Cys Gln Asp Lys Asn Val Val Thr Val
245 250 255

Phe Ser Ala Pro Asn Tyr Cys Tyr Arg Cys Gly Asn Met Ala Ala Ile
260 265 270

Met Glu Ile Asp Glu Thr Met Asn Arg Ser Phe Leu Gln Phe Glu Pro
275 280 285

Ala Pro Arg Gln Ser Glu Pro Asp Val Thr Arg Lys Thr Pro Asp Tyr
290 295 300

Phe Leu
305

<210> 14
<211> 353
<212> PRT
<213> Physcomitrella patens

<400> 14
Met Gly Ile Tyr Leu Cys Ser Pro Lys Thr Asp Lys Thr Ser Glu Asp
1 5 10 15
Asp Glu Asn Ala Glu Leu Arg Tyr Gly Leu Ser Ala Met Gln Gly Trp
20 25 30
Arg Asp Ser Met Glu Asp Ala His Lys Ala Ile Leu Asn Val Asp Lys
35 40 45
Asn Thr Ser Thr Ser Ile Phe Gly Ile Phe Asp Gly His Gly Gly Lys
50 55 60
Leu Val Ala Lys Phe Cys Ala Lys His Leu His Gln Glu Val Leu Lys
65 70 75 80
Ser Glu Ala Tyr Ala Lys Gly Asp Leu Lys Ala Ser Leu Glu Tyr Ser
85 90 95
Phe Leu Arg Met Asp Glu Met Met Lys Gly Ala Ser Gly Trp Lys Glu
100 105 110
Leu Gln Ser Leu Glu Glu Thr Ser Ser Gln Leu Asp Lys Leu Gly Asn
115 120 125
Gly Asn Ser Ser Ser Asn Ala Arg Glu Asp Asp Glu Ser Asp Tyr Ser
130 135 140

12/20

Tyr Ala Val Leu Thr Glu Ser Asn Asp Ser Asn Leu Ala Thr Lys Lys
145 150 155 160

His Lys Tyr Ser Asp Phe Gln Gly Pro Ile Tyr Gly Ser Thr Ala Val
165 170 175

Val Ala Leu Ile Arg Gly Asn Lys Leu Phe Val Ala Asn Ala Gly Asp
180 185 190

Ser Arg Cys Ile Met Ser Arg Arg Gly Glu Ala Val Asn Leu Ser Ile
195 200 205

Asp His Lys Pro Asn Leu Glu His Glu Arg Lys Arg Ile Glu Ser Ala
210 215 220

Gly Gly Phe Val His Gly Gly Arg Val Asn Gly Ser Leu Asn Leu Thr
225 230 235 240

Arg Ala Ile Gly Asp Met Glu Phe Lys Gly Arg Pro Asp Leu Pro Pro
245 250 255

Asp Lys Gln Val Val Thr Cys Cys Pro Asp Val Val Glu Val Asp Leu
260 265 270

Gly Pro Gly Asp Glu Phe Ile Val Leu Ala Cys Asp Gly Ile Trp Asp
275 280 285

Val Met Ser Ser Gln Ala Val Val Asp Phe Val Lys Ser Arg Leu Pro
290 295 300

Thr Thr Lys Thr Leu Ser Ser Leu Cys Glu Glu Ile Leu Asp Tyr Cys
305 310 315 320

Leu Ser Pro Thr Thr Arg Gln Gln Glu Gly Cys Asp Asn Met Ser Ile
325 330 335

Ile Ile Val Gln Pro Lys Gln Ser Gly Val Ala Ala Ser Ser Ser Thr
340 345 350

Asp

<210> 15
<211> 371
<212> PRT
<213> Physcomitrella patens

<400> 15
Met Val Glu Trp Val Met Lys Met Leu Met Ala Cys Trp Arg Pro Val
1 5 10 15

Gln Lys Tyr Thr His Leu Gly Glu Glu Asn Gly Asp Asn His Asp Pro
20 25 30

Leu Leu Trp His Lys Asp Leu Gly Asp His Ala Ala Gly Gln Phe Ser
35 40 45

Ile Ala Ala Val Gln Ala Asn Ala Ile Leu Glu Asp Met Val Gln Val
 50 55 60
 Glu Thr Gly Pro Phe Gly Thr Phe Val Gly Val Tyr Asp Gly His Gly
 65 70 75 80
 Gly Pro Glu Ala Ser Arg Tyr Val Asn Asp Ser Leu Tyr Arg His Leu
 85 90 95
 Gln Lys Phe Ala Thr Gln His Gly Gly Met Ser Ser Glu Val Leu Gln
 100 105 110
 Gln Ala Phe Lys Gln Thr Glu Glu Gly Phe Leu Glu Ile Val Arg Asp
 115 120 125
 Ser Trp Leu Thr Lys Pro Gln Ile Ala Ala Val Gly Ser Cys Cys Leu
 130 135 140
 Val Gly Val Val Trp Glu Cys Lys Leu Tyr Ile Ala Ser Leu Gly Asp
 145 150 155 160
 Ser Lys Ala Val Leu Gly Arg Phe Ser Arg Asn Leu Gln Ser Val Ile
 165 170 175
 Ala Thr Glu Ile Ser Thr Glu His Asn Ala Ser Val Glu Ala Val Arg
 180 185 190
 Gln Asp Leu Gln Ala Ala His Pro Asp Asp Pro Arg Ile Val Val Leu
 195 200 205
 Arg His Gly Val Trp Arg Val Lys Gly Leu Ile Gln Val Ser Arg Ser
 210 215 220
 Ile Gly Asp Val Tyr Leu Lys Lys Ala Glu Phe Asn Arg Glu Pro Leu
 225 230 235 240
 Ile Gly Arg Phe Arg Leu Pro Glu Pro Leu Gln Arg Pro Val Met Ser
 245 250 255
 Ala Glu Pro Asp Ile Arg Val Ile Asp Leu Thr Pro Asp Val Glu Phe
 260 265 270
 Val Ile Phe Ala Ser Asp Gly Leu Trp Glu His Leu Ser Asn Gln Glu
 275 280 285
 Ala Val Asp Ile Val His Lys Tyr Pro Arg Ala Gly Ile Ala Arg Gln
 290 295 300
 Leu Ile Arg Tyr Ala Leu His Glu Ala Ala Lys Lys Arg Glu Met Arg
 305 310 315 320
 Tyr Ser Asp Leu Lys Lys Ile Glu Arg Gly Ile Arg Arg His Phe His
 325 330 335
 Asp Asp Ile Thr Val Val Val Val Phe Leu Asp His Asn Leu Val Ser
 340 345 350

100230 2023360
 100230 2023360

<210>	20
<211>	34
<212>	DNA


```
<400> 29
gcgatatcga aggcagaagg caactcccag tt 32
```

<220>
<223> Description of Artificial Sequence: Primer

```
<210> 31
<211> 25
<212> DNA
<213> Artificial Sequence
```

```
<400> 31
gggcttcgtg agccatgaat ccctt
```

```
<210> 32
<211> 34
<212> DNA
<213> Artificial Sequence
```

<220>
<223> Description of Artificial Sequence: Primer

<400> 32
atccccgggcg tggaaggaga ggcgaatgtg gagg 34

```
<210> 33
<211> 32
<212> DNA
<213> Artificial Sequence
```

<220>
<223> Description of Artificial Sequence: Primer

<400> 33
gcgagctcct gtgggtgtct agcttcaggt tc 32

```
<210> 34
<211> 30
<212> DNA
<213> Artificial Sequence
```

<220>
<223> Description of Artificial Sequence: Primer

<400> 34

30

<220>
<223> Description of Artificial Sequence: Primer

35

<220>
<223> Description of Artificial Sequence: Primer

25

<220>
<223> Description of Artificial Sequence: Primer

25

<220>
<223> Description of Artificial Sequence: Primer

26

<220>
<223> Description of Artificial Sequence: Primer

<400> 39	ctggcgacag aggaggacgc gttgt	25
<210> 40		
<211> 26		
<212> DNA		
<213> Artificial Sequence		
<220>		
<223> Description of Artificial Sequence: Primer		
<400> 40	gcgtaggctc ttctacatct cgcaac	26
<210> 41		
<211> 27		
<212> DNA		
<213> Artificial Sequence		
<220>		
<223> Description of Artificial Sequence: Primer		
<400> 41	cggtacgatct tgggtggagga gtggaac	27
<210> 42		
<211> 25		
<212> DNA		
<213> Artificial Sequence		
<220>		
<223> Description of Artificial Sequence: Primer		
<400> 42	gtgtcgagcg atggagacag accac	25
<210> 43		
<211> 25		
<212> DNA		
<213> Artificial Sequence		
<220>		
<223> Description of Artificial Sequence: Primer		
<400> 43	cggatggatg agatgatgaa gggag	25
<210> 44		
<211> 26		
<212> DNA		
<213> Artificial Sequence		

<223> Description of Artificial Sequence: Primer

cacgaccacc atggacgaag cctcca

26

<211> 26

<213> Artificial Sequence

<223> Description of Artificial Sequence: Primer

ggctgtgctc ggtagattct ctcgca

26

<211> 25

<213> Artificial Sequence

<223> Description of Artificial Sequence: Primer

cagcctcttg gttggacaag tgctc

25